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PESTS NOT KNOWN TO OCCUR IN THE UNITED STATES OR OF LIMITED DISTRIBUTION NO. 74: CABBAGE MOTH

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Pest

CABBAGE MOTH
Mamestra brassicae L.

Selected Synonyms

Phalaena omicron Geoffroy in Fourcroy 1785
Noctua albidilinea Haworth 1809
Barathra brassicae; (L.) 1821
Mamestra brassicae var. *andalusica* Spaudinger 1871
Mamestra brassicae var. *decolorata* Spaudinger 1889
Hypobarathra unicolor Marumo 1917

Order: Family

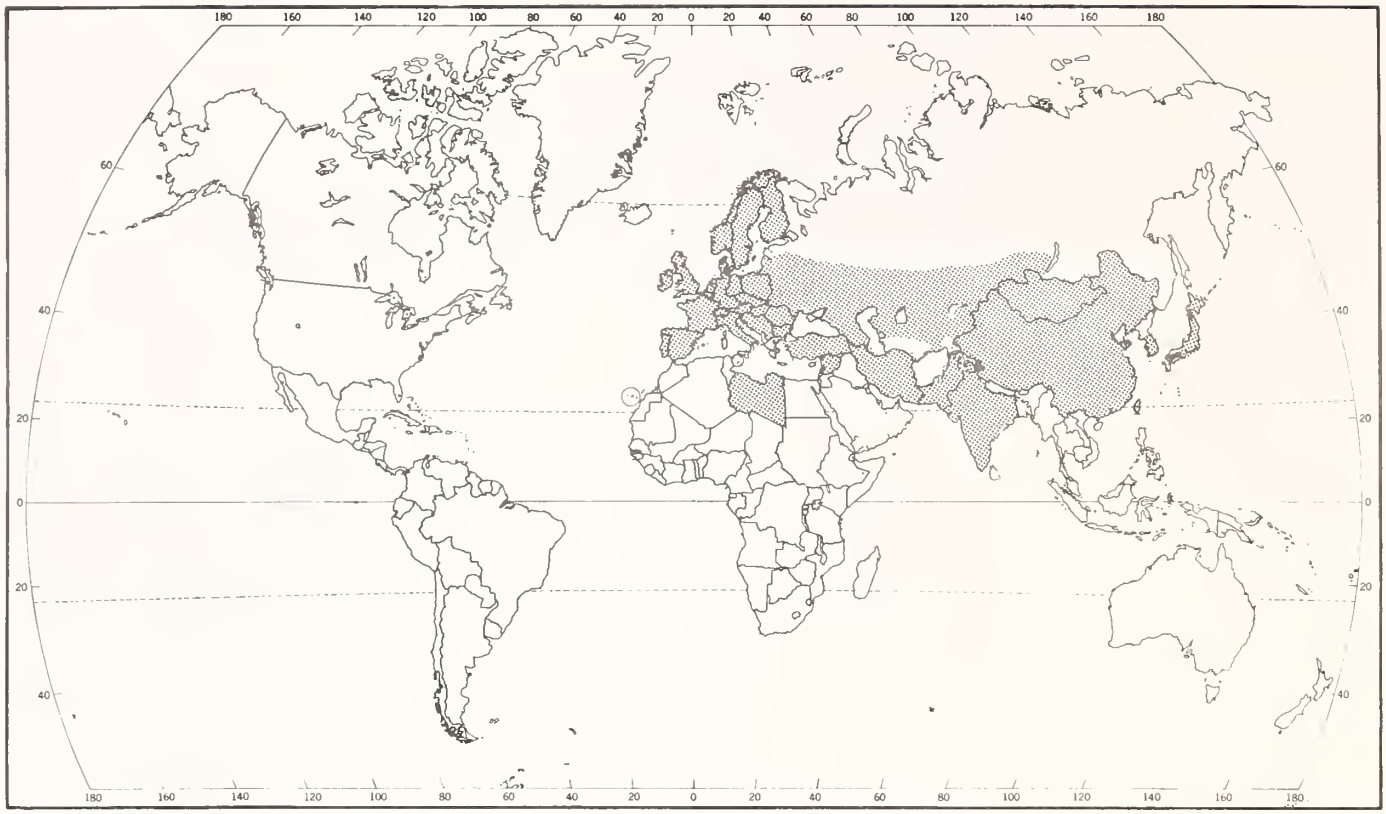
Lepidoptera: Noctuidae

Economic Importance

In the United Kingdom, *M. brassicae* is generally a common pest of crucifers, less numerous than *Pieris* spp. (white butterflies), but *M. brassicae* larvae are more serious, because they feed inside the heads of cabbages. The fouling of the leaves with excrement makes the cabbages unfit to eat (Edwards and Heath 1964). In Italy, larvae damage leaves and florets of broccoli, but infestations in the florets are more important because the larvae are sheltered from any insecticides applied. Larvae also resemble the branches and flower stalks so closely that they often pass unnoticed through factory processing and freezing until discovered by the consumer (Ciampolini and Zangheri 1977/78). In the Krasnodar region of the Soviet Union, this species causes considerable damage to sugar beet. A single larva destroys 15 percent of the leaf, while two or three destroy 35-70 percent. The economic threshold is one larva per plant or seven or eight per sq m (Tanskiĭ et al. 1980). In Hungary, up to 22 percent of the sugar beet yield was reduced in 1979 and 1980 (Szeoke 1983).

General Distribution

The range of the moth extends throughout the Palearctic region from Europe to Japan and into subtropical Asia. Commonwealth Institute of Entomology (1984) listed the following distribution unless cited otherwise: AFRICA - Canary Islands and Libya; ASIA - China (including Taiwan), Iran, Japan (Oku and Kobayashi 1973), Lebanon, Mongolia, Pakistan, South Korea, Syria, and Turkey; EUROPE - Austria, Belgium, Bulgaria, Czechoslovakia, Denmark, East Germany, Finland, France, Hungary, Italy, Malta, Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland, United Kingdom (including Ireland), West Germany, and Yugoslavia; and SOVIET UNION - Armenian S.S.R., Azerbaijan S.S.R., Byelorussian S.S.R., Chuvash A.S.S.R. (Arkhipov 1979), Georgian S.S.R., Kazakh, S.S.R., Kirghiz S.S.R., Latvian S.S.R., Lithuanian S.S.R (Navasaitis and Shcheponavichyus 1984), Moldavian S.S.R., southern Russian S.F.S.R., Ukrainian S.S.R., and Uzbek, S.S.R. (Adashkevich 1983).



Mamestra brassicae distribution map (Prepared by Non-Regional Administrative Operations Office and Biological Assessment Support Staff, PPQ, APHIS, USDA).

Hosts

The larvae of M. brassicae feed on various cultivated and wild plants, mainly crucifers. This pest has been recorded on Allium cepa (onion) (Leonard 1948), Amaranthus retroflexus (redroot pigweed) (Straka 1975), Beta vulgaris (beetroot (Carter 1984), sugar beet (Leonard 1948)), Betula pendula (European white birch) (Stokoe 1948), Brassica napus (rape (Carter 1984)), Chinese cabbage (Yokoi and Tsuji 1975)), Brassica oleracea (broccoli, brussels-sprouts, cabbage, cauliflower (Carter 1984), kohlrabi (Kagan 1975)), Brassica rapa (turnip) (Leonard 1948), Calendula spp., Cannabis sativa (hemp) (Paddock 1978), Capsella bursa-pastoris (shepherd's purse) (Kozhanchikov 1950), Chenopodium album (lambsquarters) (Straka 1975), Chenopodium centrorubrum (Hirata 1962), Chrysanthemum spp. (chrysanthemums) (Carter 1984), Dahlia sp. (dahlia) (Paddock 1978), Daucus carota (carrot) (Leonard 1948), Dianthus caryophyllus (carnation) (Carter 1984), Dielytra spectablis (Melis 1936), Epilobium spp. (fireweeds) (Lempke 1975), Fagus sp. (beech) (Carter 1984), Gladiolus spp. (gladiolus), Glycine max

(soybean) (Paddock 1978), Geum rivale (Kozhanchikov 1950), Helianthus annuus (sunflower) (Leonard 1948), Humulus lupulus (hops) (Benedek 1968), Ipomoea batatus (sweet potato) (Hirano and Noguchi 1963), Lactuca sativa (lettuce), Larix sp. (larch), Linum usitatissimum (flax), Lupinus spp. (lupines) (Paddock 1978), Lycopersicon esculentum (tomato) (Carter 1984), Malus sylvestris (apple) (Castellari 1968-70), Medicago sativa (alfalfa) (Sherman and Lokhonya 1982), Nicotiana rustica (Aztec tobacco) (Savchenko 1935), N. tabacum (tobacco) (Carter 1984), Papaver somniferum (opium poppy) (Ostrovskii and Drozdovskaya 1970), Pelargonium spp. (geraniums), Phaseolus vulgaris (beans) (Paddock 1978), Pisum sativum (pea) (Carter 1984), Polygonum convolvulus (wild buckwheat) (Dochkova 1972), Potentilla anserina (silverweed), Prunus padus (Kozhanchikov 1950), Quercus sp. (oak) (Carter 1984), Q. cerris (European turkey oak) (Herczig et al. 1980), Q. robur (English oak) (Stokoe 1948), Raphanus sativus (radish) (Ter-Simonyan and Blinova 1981), Rheum rhabarbarum (rhubarb) (Shchegolev 1929), Rubus idaeus (European red raspberry) (Kozhanchikov 1950), Salix sp. (willow) (Leonard 1948), Salix caprea (goat willow), Sambucus racemosa (European red elder) (Kozhanchikov 1950), Senecio vulgaris (groundsel) (Lempke 1975), Solanum melongena (eggplant) (Leonard 1948), Solanum tuberosum (potato) (Carter 1984), Trifolium repens (white clover) (Kozhanchikov 1950), Vicia faba (broadbean) (Zangheri 1952), Vicia sativa (vetch), Vitis spp. (grapes) (Von Voigt 1974), and Zea mays (corn) (Paddock 1978).

Characters

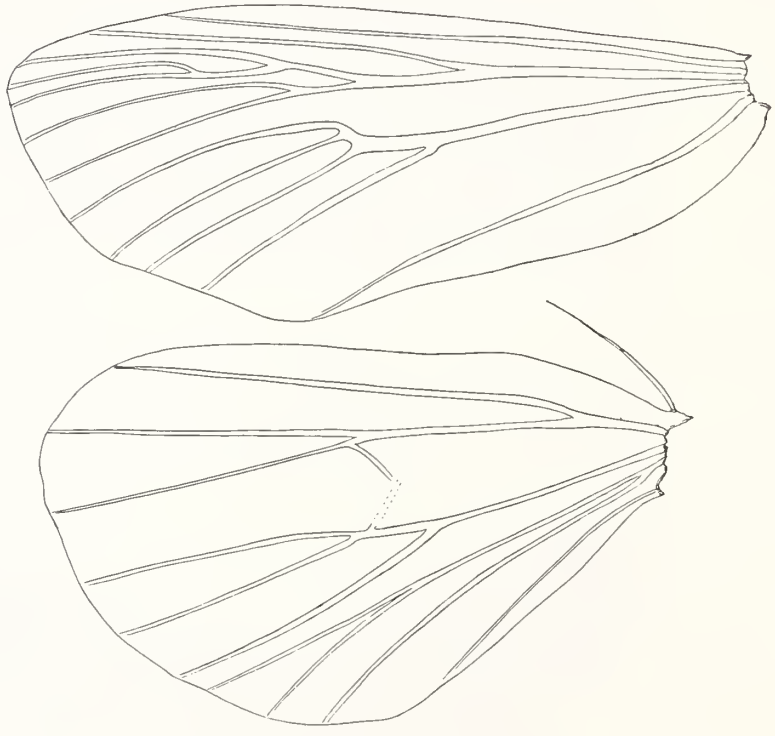
ADULTS (Fig. 1) - Wingspan 35-50 mm. Forewing gray brown to blackish brown with variable reddish-brown scaling; subbasal, antemedial and postmedial lines inconspicuous, slightly paler

(Fig. 1)

Mamestra brassicae. Female adult, dorsal view (From Melis 1936).

than ground color, finely edged darker. Subterminal line complete and clear in most specimens from southern Britain, absent or vestigal in most specimens from north. Subterminal line whitish to yellowish white with two angular projections not reaching termen (Goater 1979), inner side not whitish (U.S. Department of Agriculture 1958); stigmata outlined black, reniform with whitish distal margin and less clearly defined proximal margin. Hindwing fuscous; discal spot grayish fuscous; terminal shade brownish fuscous; fringe white with fine grayish central line (Goater 1979). See wing venation in Fig. 2. Head and thorax dark grayish brown flecked with white; thorax with slight dorsal crest; abdomen pale grayish brown with darker dorsal tufts (Carter 1984). Antenna shortly ciliate, in male densely, in female sparsely (Goater 1979). Legs brown, base very hairy (Paddock 1978); fore tibia slightly curved with apically pointed spur (Goater 1979).

(Fig. 2)

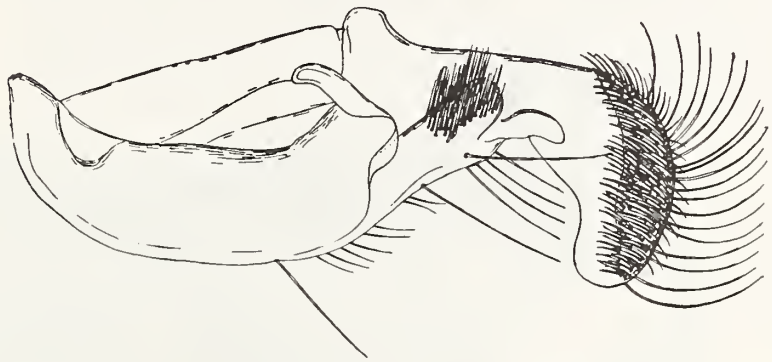


Mamestra brassicae. Wing venation, dorsal view (From Melis 1936).

The slightly curved fore tibia with an apically pointed spur, and hair on the eyes distinguish M. brassicae from most similar species (Goater 1979) and species of the closely related genus

Polia. A subterminal line not defined by whitish on inner side of the forewing separates M. brassicae from the domestic M. configurata Walker (bertha armyworm), which has a subterminal line prominently defined by whitish on the inner side (U.S. Department of Agriculture 1958). Male genitalia (Fig. 3) distinguishes this species from North American species (R. W. Poole*).

(Fig. 3)



Mamestra brassicae male genitalia. Right valve, lateroventral view (From Melis 1936).

EGGS (Fig. 4) - Hemispherical; ribbed, finely reticulated; pale brown with pink clouding around micropyle, pink ringed towards base (Carter 1984).

(Fig. 4)

Mamestra brassicae eggs, dorsal view (From Saynor 1976).

LARVAE (Figs. 5-7 and 8) - Average 30 mm long (Paddock 1978). Head pale yellowish brown or dark brown with pale maculation. (Carter 1984). Body brown to grayish green, paler below spiracular line and flecked with white; diffuse dorsal line

* Systematic Entomology Laboratory, Biosystematics and Beneficial Insects Institute, Agricultural Research Service, USDA, c/o U.S. National Museum (USNM), Washington, DC 20560.

(Figs. 5-7)

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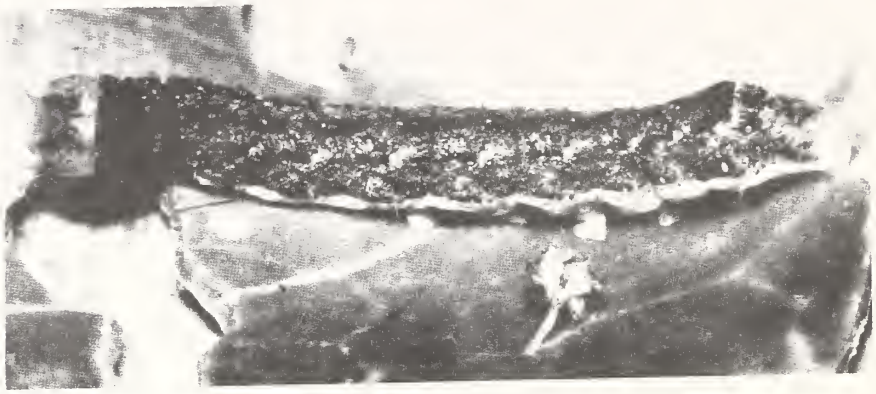

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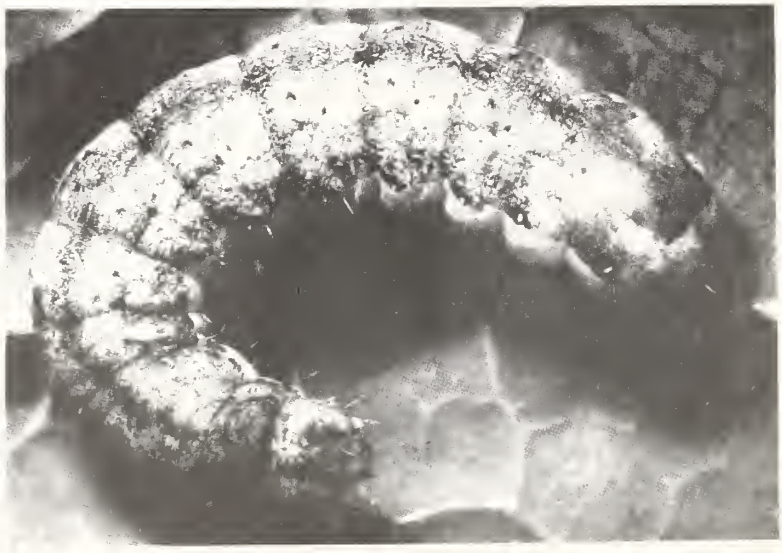

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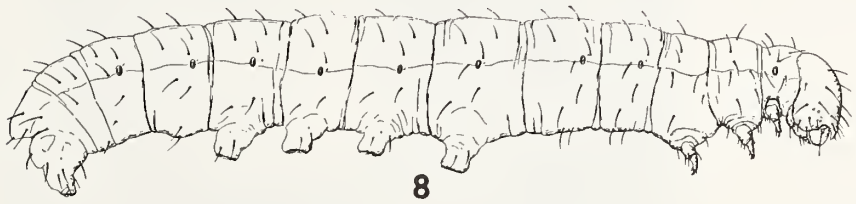
Mamestra brassicae larvae. 5. Third instar about to molt, lateral view. 6. Same larva showing color change in fourth instar, abdominal segment 8 with dark, rectangular dorsal patch, dorsolateral view. 7. Final instar showing dark patches around spiracles, dorsolateral view (From Emmett 1981).

dark brown, with pale spot on each segment; subdorsal line pale, indistinct, with more or less clearly defined black streak on segments 1-8, those on abdominal segment 8 joined posteriorly by dorsal transverse band; pale oblique lines extend from subdorsal to dorsal line on abdominal segments; spiracular line ochreous yellow to orange, margined with white dorsally; spiracles white with black peritreme, each surrounded by dark spot; pinacula and prothoracic and anal plates concolorous with integument. Early instars yellowish green or pale bluish green, white flecked, intersegmental rings; distinctly paler; other markings indistinct (Carter 1984). Mandible with large molar bearing basal process on oral surface (Fig. 9).

(Figs. 8-9)



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Mamestra brassicae larva. 8. Body, lateral view. 9. Mandible, ventral view (From Melis 1936).

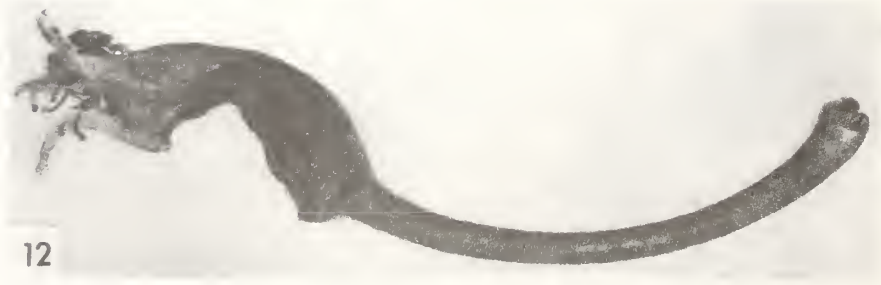
Larvae of M. brassicae may be confused with the domestic Pieris rapae (L.) (small white butterfly) and the exotic P. brassicae (L.) (large white butterfly). Color varies, but M. brassicae larvae have a smooth skin and few hairs while P. rapae and P. brassicae appear velvety (Emmett 1979).

PUPAE - Elongate, reddish brown; wing and limb cases finely sculptured; abdominal segments evenly tapered, darker brown and smooth, each with finely pitted anterior band; segment 8 sharply excavated to narrowly conical cremaster with two short, apically hooked spines (Goater 1979).

Characteristic Damage

Crucifers show characteristic skeletonizing and tunneling (Fig. 10). Masses of frass contaminate the plants (Paddock 1978). On apples, the lower epidermis and parenchyma of leaves are gnawed between the veins (Fig. 11), eventually leaving only the largest veins. Later, the exocarps and carpels are excavated (Fig. 12), stopping further growth (Castellari 1968-70).

(Figs. 10-12)



Mamestra brassicae larval damage. 10. Cabbage (From de Giovanni 1973). 11. Apple leaf. 12. Small apple (From Castellari 1968-70).

Detection Notes

PPQ has intercepted Mamestra brassicae, mostly in the larval stage. This pest has most commonly been intercepted with various species of Brassica such as cabbage and broccoli in ship's stores from Europe and Asia. Beets and celery have also been infested in ship's stores. These materials are regulated under Title 7, Part 319.56 and Part 352 of the Code of Federal Regulations. Larvae were also found on various kinds of cut flowers shipped to the United States from the Netherlands. Alstroemeria and Aconitum cut flowers are found infested most frequently. Reported interceptions on various kinds of flowers may be other species, for larvae of M. brassicae are difficult or in many cases impossible to separate from closely related species in Europe. Entry of cut flowers is regulated under Part 319.74. Imported cut flowers are subject to inspection and treatment as may be required by inspection findings. Many of its hosts are either strictly regulated or prohibited as propagation materials under Part 319.37.

The number of interceptions at U.S. ports of entry from 1975 to 1986 was as follows: cargo 106, stores 91, and baggage 6, mainly on Brassica spp. Interceptions were made most often from the Netherlands. Other interceptions were made from Belgium, China, France, Italy, Korea, Norway, Portugal, Soviet Union, Spain, Sweden, Turkey, United Kingdom, and Yugoslavia. Interceptions from Greece, Japan, and Morocco (countries not recorded in the literature) may represent transshipments from other areas.

This species may be detected in the following ways.

1. Look for eggs on the undersides of leaves, petioles, or stems.

2. Search for larvae when cabbages are cut open.

3. Examine undersides of mined leaves of host plants and excavated small fruits of apples for larvae.

For identification, submit suspect adult specimens pinned and labeled, and larvae and pupae in alcohol.

Biology

In Bulgaria, M. brassicae develops two generations annually, sometimes a partial third (Nikolova 1945); while in the United Kingdom, it has one generation a year with a partial second generation sometimes (U.S. Department of Agriculture 1958). The different broods overlap, resulting in larvae being found from June to October or even later (Emmett 1979). In Bulgaria, the pupae overwinter. New adults emerge in early April and May and those of the first generation in late June and July.

Females survive 9-27 days and males 8-25 when fed on sugar water, but unfed adults live only 5-6 days. They fly at night and usually mate 2-3 days after emergence (Nikolova 1945). Oviposition occurs when the optimum temperature is 19-21° C (Noll 1963). Females deposit 6-25 batches of 15-188 eggs with totals ranging from 438 to 2,725 eggs for 3-7 days. The eggs are laid on leaves (Nikolova 1945) (generally on the undersides (Emmett 1979)), petioles, and stems of cabbage, and to a lesser extent on other plants. The eggs hatch in 6-9 days in the field and less in the laboratory (Nikolova 1945).

The larvae feed voraciously on the leaves of cabbage and bore into the heads (Jones and Jones 1974). They sometimes feed in heads and stalks (U.S. Department of Agriculture 1958). The larvae are usually active at night and are cannibalistic (Melis 1936). They often curl up if disturbed (Carter 1984). They pass through 5 molts in 25-30 days or longer (Paddock 1978). Temperature affects the color of the last instar larvae, the percentage of dark ones being highest at 20-22° C and lowest at 28° C. Crowding induces rapid development at 25-28° C and slow development at 20-22° C (Hirata 1962). Oku (1973) reported larval migrations of the sixth instar when the food supply was exhausted.

In Bulgaria, full-grown larvae burrow into the soil to pupate (Nikolova 1945), 5-6 cm deep. Pupation may occur under rocks, clods, and sometimes in an earthen cell (Paddock 1978). The pupal stage in the laboratory lasts 13-36 days in the summer and 176-482 days for overwintering pupae (Nikolova 1979). In the Soviet Union, the temperature thresholds for diapause in the laboratory are 10.5° C for continuous light and 22.5° C for short day conditions (Gasanov 1979).

On apple in Italy, the larvae at first are gregarious and stay on the underside of the leaves, feeding on the lower epidermis and parenchyma, without damaging the veins and upper epidermis; then they become solitary and eat the whole leaf blade, leaving the largest veins. After the first molts, the larvae prefer the small fruits to the leaves. They gnaw the epicarp and reach the carpels. The full-grown larvae leave the fruits and enter the soil to pupate 2-12 cm deep. The second generation larval population feeds in great numbers on some species of wild plants and on fallen apples, and sometimes climbs trees, to feed voraciously on leaves and fruits. When in October the minimum temperature is a little above zero, the larvae enter the soil to pupate (Castellari 1968-70).

Control

These pests are best controlled as soon as possible after hatching from the eggs because the larvae are very difficult to reach with pesticides and kill once they have entered the rosette of a crucifer plant (Emmett 1979).

Literature Cited

Adashkevich, B. P. Biological protection of cruciferous vegetable crops against harmful insects. Tashkent, USSR: Izdatel'stvo "FAN" Uzbekskoi SSR; 1983 (In Russian). Taken from: Rev. Appl. Entomol. Ser. A, 72(12):929; 1984.

Arkhipov, G. E. Effects of BTB on pests of cabbage. Zashch. Rast. 12:27-28; 1979 (In Russian). Taken from: Rev. Appl. Entomol. Ser. A, 68(11):727; 1980.

Benedek, M. I. A study of pests of hops in Hungary. Növényved. Kut. Intéz. Évk. 11:49-59; 1968 (In Hungarian; Russian and English summaries). Taken from: Rev. Appl. Entomol. Ser. A, 57(8):473; 1969.

Carter, D. J. Pest Lepidoptera of Europe with special reference to the British Isles. Boston: Dr. W. Junk, Kluwer Academic Publishers; 1984: 282-283.

Castellari, P. L. Observations on the behaviour of two species of Noctuidae (Lepidoptera) (Mamestra brassicae L. and Mamestra oleracea L.) injurious to apple trees. Boll. Ist. Entomol. Univ. Studi Bologna 29:136-137; 1968-70 (In Italian; English summary).

Ciampolini, M.; Zangheri, S. Severe and typical damage by Mamestra brassicae L. (Lepidoptera, Noctuidae) to broccoli crops in the Foggia district. Boll. Zool. Agrar. Bachic. 14:173-179; 1977/1978 (In Italian). Taken from: Rev. Appl. Entomol. Ser. A, 68(11):704; 1980.

Commonwealth Institute of Entomology. Distribution maps of pests. Map 467. London: Commonwealth Agricultural Bureaux; 1984.

de Giovanni, G.; Brunelli, A.; Ponti, I. Experiments for the control of M. brassicae insect pests. Ital. Agric. 110(1): 117-126; 1973 (In Italian).

Dochkova, B. Some ecological studies on Mamestra brassicae L. (Lepidoptera, Noctuidae). Gradinar. Lozar. Nauk 9(1):77-86; 1972.

Edwards, C. A.; Heath, G. W. The ways in which insects are important to the farmer. In: The principles of agricultural entomology. Springfield, IL: Charles C. Thomas, Publisher; 1964: 28-30, 35-36, 275-276.

Emmett, B. J. Cabbage caterpillars. Ministry of Agriculture, Fisheries and Food Leaflet 69, revised; 1979 and 1982.

_____. Key for the identification of lepidopterous larvae infesting brassica crops. Plant Pathol. 29(3):122-123, plates VI-VII; 1980. Taken from: Rev. Appl. Entomol. Ser. A, 69(8):572; 1981.

Gasanov, O. G. Effect of temperature on the qualitative and quantitative photoperiodic reactions in Noctuidae. Zool. Zhurnal 58(6):926-928; 1979 (In Russian; English summary). Taken from: Rev. Appl. Entomol. Ser. A, 68(5):283; 1980.

Goater, B. Noctuidae. Heath, J.; Emmet, A. M., editors. The moths and butterflies of Great Britain and Ireland. Vol. 9. London: The Curwen Press; 1979: 120, 214-215, plate II.

Herczig, B.; Ronkay, L.; Szaboky, Cs. Data to the knowledge of the natural food-plants of lepidopterous larvae in Hungary. Folia Entomol. Hung. 33(1):67-73; 1980. Taken from: Rev. Appl. Entomol. Ser. A, 70(1):29; 1982.

Hirano, C.; Noguchi, H. Food utilization of the last instar larvae of the cabbage armyworm, Mamestra brassicae L., fed on plant leaves of different food values. Jap. J. Appl. Entomol. Zool. 7(4):311-315; 1963 (In Japanese; English summary). Taken from: Rev. Appl. Entomol. Ser. A, 52(12):564; 1964.

Hirata, S. On the phase variation of cabbage armyworm, Mamestra (Barathra) brassicae (L.). VI. Phase variation in larval characters under different conditions of density and temperature. Jap. J. Ecol. 12(6):223-228; 1962.

Jones, F. G. W.; Jones, M. G. Pests of field crops. 2d ed. New York: St. Martin's Press; 1974: 103, 106, 108.

Kagan, F. Characteristics of the development, appearance and injuriousness of some main pests of vegetable plants in Poland in 1973. Biul. Inst. Ochr. Rosl. 58:265-291; 1975 (In Polish; English and Russian summaries). Taken from: Rev. Appl. Entomol. Ser. A, 64(11):1880; 1976.

Kozhanchikov, I. V. The conditions under which the cabbage moth (Barathra brassicae L.) feeds on new plants. Dokl. Akad. Nauk SSSR (N.S.) 73(2):385-387; 1950 (In Russian). Taken from: Rev. Appl. Entomol. Ser. A, 40(7):220-221; 1952.

Lempke, B. J. Notable food plants for Mamestra brassicae L. (Lep., Noctuidae). Entomol. Ber. 35(1):102; 1975 (In German).

Leonard, M. D. Foreign insects injurious to cruciferae. Part 1. Oakley, R. G., editor. Manual of foreign plant pests; 1948: 66-67.

Melis, A. Contributo alla conoscenza morfo-biologica della Polia (Mamestra) pisi L. Redia; Giornale di Entomol. 22:1-31, 4 Tav.; 1936.

Navasaitis, V. M.; Shcheponavichyus, Sh. V. Macrolepidoptera of the 'Kamsa' botanical-zoological conservation area. Acta Entomol. Litu. 7:103-117; 1984 (In Russian; English summary). Taken from: Rev. Appl. Entomol. Ser. A, 73(2):67; 1985.

Nikolova, V. Cabbage moth--Mamestra (Barathra) brassicae L. as a cabbage pest in Bulgaria and its control. Agric. Sci. I. Plant Ind. 1(1):123-156; 1945 (In Bulgarian; Russian and English summaries). Taken from: Rev. Appl. Entomol. Ser. A, 35(12):385; 1947.

Noll, J. On the influence of temperature on the duration of life of the adults, on the commencement, course and duration of oviposition, as well as on the egg-production, of M. brassicae and in importance for the population dynamics of the pest. Nachrichtenbl. Dtsch. Pflanzenschutzdienstes (N.F.) 17(1):9-24; 1963 (In German; Russian and English summaries). Taken from: Rev. Appl. Entomol. Ser. A, 52(8):368; 1964.

Oku, T.; Kobayashi, T. Some dynamic aspects of field populations of the cabbage armyworm, Mamestra brassicae Linne, in Tohoku District. II. Mortalities during the progress and breakdown of an outbreak on the sugarbeet. Kontyu 41(3):267-279; 1973.

Ostrovskii, N. I.; Drozdovskaya, L. S. The basic pests and diseases of poppies. Zashch. Rast. 15(11):27-29; 1970 (In Russian). Taken from: Rev. Appl. Entomol. Ser. A, 62(7):698; 1974.

Paddock, E. Cabbage moth. Detection manual (revision) D.T. 3:62. State of California, Department of Food and Agriculture, Division of Plant Industry, Exclusion and Detection; 1978.

Savchenko, E. N. On the influence of insecticide sprays on N. rustica and cigar tobacco plants. Sborn. Rab. Entomol. Otd. VIMPa [Coll. Works. Entomol. Sect. All-Un. Inst. Makhorka Ind.], Kiev, 31-69; 1935 (In Russian). Taken from: Rev. Appl. Entomol. Ser. A, 24(2):52; 1936.

Saynor, M. Cabbage caterpillars. Ministry of Agriculture, Fisheries and Food, Agricultural Development and Advisory Service Advisory Leaflet 69, revised; 1976.

Shchegolev, V. N. Owlet-moths as pests of technical plants in the North Caucasus. Plant Prot. 6(3-4):399-406; 1929 (In Russian). Taken from: Rev. Appl. Entomol. Ser. A, 18(12): 670; 1930.

Sherman, L. V.; Lokhonya, R. N. The pheromone method of lucerne surveillance. Zashch. Rast. 1:47; 1982 (In Russian). Taken from: Rev. Appl. Entomol. Ser. A, 71(5):402-403; 1983.

Stokoe, W. J. The caterpillars of British moths. New York: Frederick Warne & Co. Ltd.; 1948: 214-215.

Straka, F. Influence of food on the resistance of larvae of the cabbage moth (Mamestra brassicae L. Lepidopt., Noctuidae) to Thiodan 35 EC. Dokl. Sel'sko Khozyaĭstvennoĭ Akad. Im. Georgiya Dimitrova 8(1):57-60; 1975 (In German). Taken from: Rev. Appl. Entomol. Ser. A, 64(1):31; 1976.

Szeoke, K. The significance of Mamestra brassica L. in sugarbeet. Novenyvedelem 19(8):372-373; 1983 (In Hungarian). Taken from: Rev. Appl. Entomol. Ser. A, 72(1-3):101; 1984.

Tanskiĭ, V. I.; Agarkov, V. M.; Kurilo, V. N. Economic threshold of injuriousness of the cabbage moth. Zashch. Rast. 10:11; 1980 (In Russian). Taken from: Rev. Appl. Entomol. Ser. A, 69(8):577; 1981.

Ter-Simonyan, L. G.; Blinova, Z. P. Pests and diseases of crucifers. Zashch. Rast. 3:56-58; 1981 (In Russian). Taken from: Rev. Appl. Entomol. Ser. A, 69(12):890; 1981.

U.S. Department of Agriculture, Agricultural Research Service, Plant Pest Control Division. Insects not known to occur in the United States. Cabbage moth (Mamestra brassicae (L.)). U.S. Department of Agriculture, Coop. Econ. Insect Rep. 8(41):873-874; 1958.

Von Voigt, E. Damages by larvae of the cabbage moth (Mamestra brassicae L.) in Hungarian vineyards. Weinberg Keller 21(6): 281-288; 1974.

Yokoi, S.; Tsuji, H. Experimental studies on the movement behaviour of the final instar noctuid larvae of the cabbage armyworm and the tobacco cutworm. Jap. J. Appl. Entomol. Zool. 19(3):157-161; 1975 (In Japanese; English summary). Taken from: Rev. Appl. Entomol. Ser. A, 65(1):45; 1977.

Zangheri, S. Contributions to knowledge of the insect fauna of leguminous seed plants. I. Preliminary note on the insect fauna of peas and broad beans. Boll. Ist. Entomol. Bologna 18(1950-51):93-116; 1952 (In Italian). Taken from: Rev. Appl. Entomol. Ser. A, 42(4):109; 1954.